

## Lesson 3: Constructing Circle Graphs

### Selected Content Standards

#### **Benchmarks Addressed:**

- D-1-M** *Systematically collecting, organizing, describing, and displaying data in charts, tables, plots, graphs, and/or spreadsheets*
- D-2-M** *Analyzing, interpreting, evaluating, drawing inferences, and making estimations, predictions, decisions, and convincing arguments based on organized data (e.g., analyze data using concepts of mean, median, mode, range, random samples, sample size, bias, and data extremes)*

#### **GLEs Addressed:**

Grade 7

31. Analyze and interpret circle graphs, and determine when a circle graph is the most appropriate type of graph to use (D-2-M)

Grade 8

36. Organize and display data using circle graphs (D-1-M)

#### **GEE 21 Connection**

Students will be required to

- Construct circle graphs from given sets of data.
- Interpret and summarize a set of experimental data presented in a circle graph in context.
- Draw conclusions from a variety of circle graphs.

### Translating Content Standards into Instruction

#### **A. Circle graphs**

A circle graph is used to show the relationship of parts to a whole and to each other. Each pie-shaped wedge represents a fractional part of a whole. Data that lend themselves well to circle graphs are family budgets, percentage of time students study each academic subject, or how a student spends a typical day. On **Student Worksheet #1** students are expected to construct a circle graph on how they spend their day. **Student Worksheet #2** has a completed circle graph with questions for students to answer. **Student Worksheet #1** will not have an answer sheet, but it should look like the example below. **Student Worksheet #2** has an answer sheet.

### Steps to constructing a circle graph:

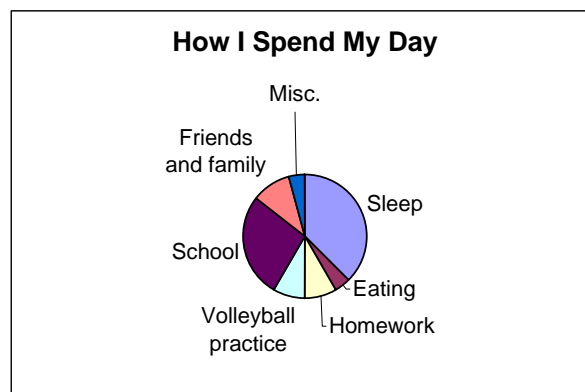
These instructions are found on the **Student Worksheet #2**. What you see below is also on a **Teacher Blackline** master.

1. Set up a table, giving to each category the fractional part of a whole each category represents, and the number of degrees of each category found, by multiplying the fractional part by 360. The sum of the parts should add up to 360 degrees.
2. Draw a large circle with the compass or with a pattern. Locate the center of the circle.
3. Use a protractor to draw central angles, with the number of degrees representing each category.
4. Label each wedge, or color them and show the legend for the colors.
5. Give the circle graph a title.

Example: Mrs. Johnson's class decided to construct circle graphs showing how each student spent a typical school day. Kristen's day went as follows: 8.5 hours of sleep, 1.5 hours eating, 2 hours homework, 2 hours volleyball practice, 6.5 hours in school, 1 hour miscellaneous activities, and 2.5 hours for friends and family. She set up a table as shown below: Using her calculator she divided the number of hours in each category by 24 and then multiplied that by 360 degrees.

Category	Hours	Fractional part of 24 hours	Number of degrees
Sleep	9	$9/24$	135
Eating	1	$1/24$	15
Homework	2	$2/24$	30
Volleyball practice	2	$2/24$	30
School	6.5	$6.5/24$	98
Friends and family	2.5	$2.5/24$	37
Miscellaneous	1	$1/24$	15

Finally, she drew a circle and located the center. With her protractor, she constructed successive central angles, using the number of degrees representing each part. She labeled each pie-shaped wedge with the category. She gave the graph a title above the circle.



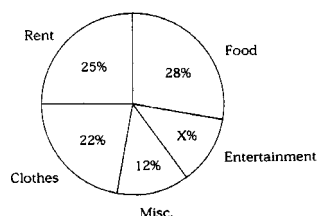
## Sources of Evidence of Student Learning

### GEE 21 Connection

These benchmarks may be assessed either by multiple-choice questions or a free response question. Below are four examples of what students might see in a multiple-choice question. These were taken from the Illinois and Massachusetts state tests, either of which can be accessed on the Department of Education Web site.

1. Mr. Brown makes \$350 a week. How much money does he spend on entertainment each week?

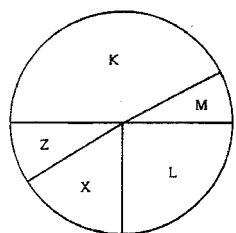
**HOW MR. BROWN  
SPENDS HIS MONEY EACH WEEK**



- A. \$13.00
- B. \$42.00
- C. \$45.50\*
- D. \$87.50
- E. \$98.00

2. The circle graph represents sales of five different types of automobiles. Which automobile accounted for about 25% of the sales?

**Sales of Automobiles**

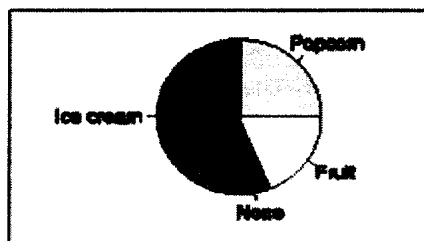


- A. K
- B. L\*
- C. M
- D. X
- E. Z

3. Consider a school of 2000 students. Based on the data in the graph, about how many of the 2000 students would you expect to choose fruit as their favorite snack?

- A. 750
- B. 400\*
- C. 150
- D. 100

**Favorite Snack**



4. According to the 1990 U.S. Census, 27.2% of Massachusetts residents over the age of 25 had graduated from a 4-year college. In a circle graph representing all Massachusetts residents over the age of 25, about how many degrees should be in the sector representing these 4-year college graduates?
- A.  $27^\circ$       B.  $17^\circ$       C.  $98^\circ$  \*      D.  $68^\circ$

*The Massachusetts Comprehensive Assessment System*

### Attributes of Student Work at the “Got-It” level

Most questions related to circle graphs on the GEE 21 involve the analysis of a circle graph such as the one on **Worksheet #2**. However, it is very important that a student knows how a circle graph is constructed before he/she begins to analyze such a graph.

This is an open response problem from the Massachusetts Comprehensive Assessment System.

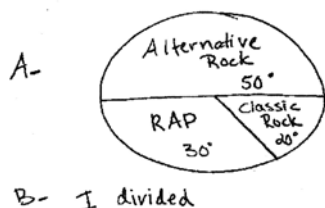
A tenth grade class took a survey and found that the most popular types of music in their school were alternative rock, rap, and classic rock. They took a second survey to find out the student’s preference among these three types of music. These are the results for 120 students.

Favorite Types of Music		
Alternative Rock	Rap	Classic Rock
60	40	20

- Make a rough sketch of a circle graph displaying these data. Tell how many degrees should be in each sector of the graph.
- Explain how you found the number of degrees for each sector.

### Sample Student Work

#### One-Point Response



Four-Point  
Response



$$\frac{40}{120} = \frac{x}{360}$$

$$360 \times 40 \div 120 = 120$$

$$\frac{30}{120} = \frac{x}{360}$$

$$360 \times 30 \div 120 = 90$$

boys who like alternative rock

$$\frac{60}{120} = \frac{x}{360}$$

total number of boys

how many degrees?

degrees in a circle

Cross multiply,

$$360 \times 60 \div 120 = 180^\circ$$

$$360 \times 40 \div 120 = 120^\circ$$

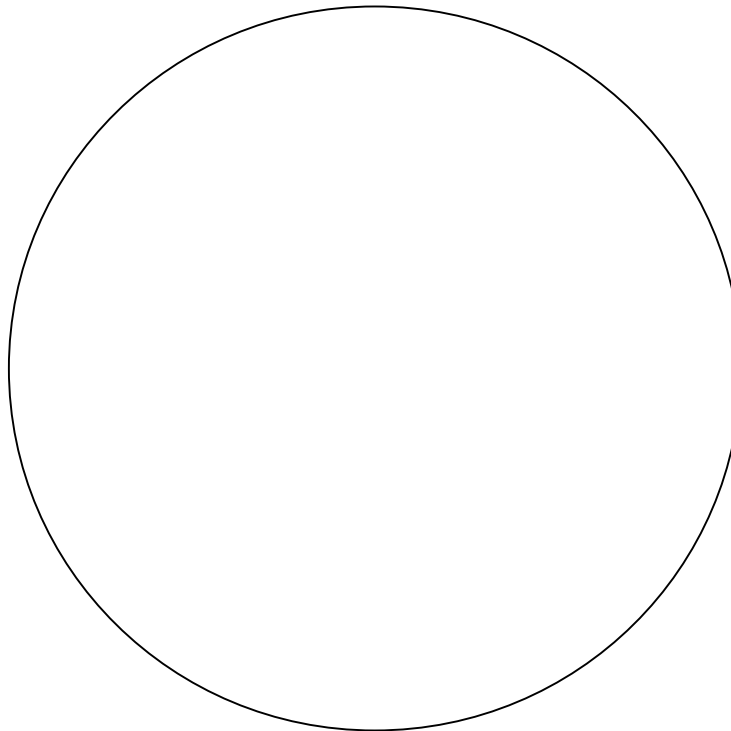
$$360 \times 30 \div 120 = 90^\circ$$

$$\frac{40}{120} = \frac{x}{360}$$

$$\frac{30}{120} = \frac{x}{360}$$

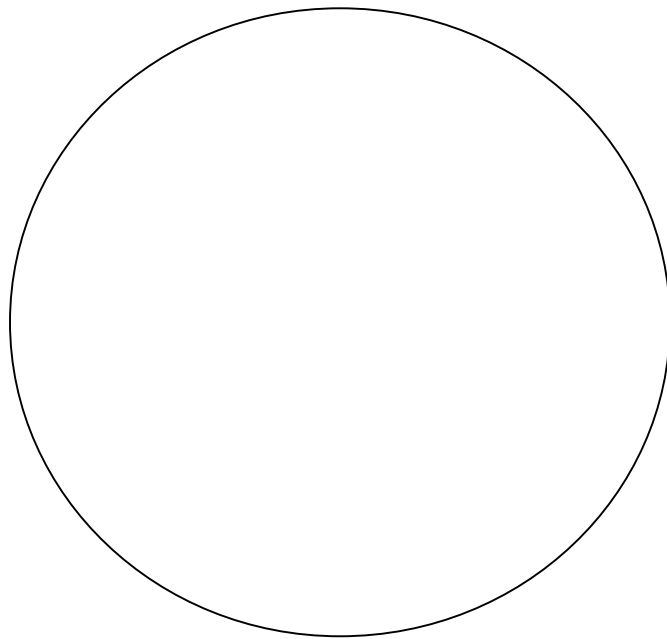
Making a circle graph.

Category	Hours	Fractional part of 24 hours	Number of degrees
Sleep	9		
Eating	1		
Homework	2		
Volleyball practice	2		
School	6.5		
Friends and family	2.5		
Miscellaneous	1		



Begin by filling in the table below listing your activities in the left column. Three categories have been filled in for you. How do you spend the rest of your day? Sports? Watching TV? Doing homework? Visiting with friends? Working?

Category	Hours	Fractional part of 24 hours	Number of degrees
Sleep			
Eating			
School			



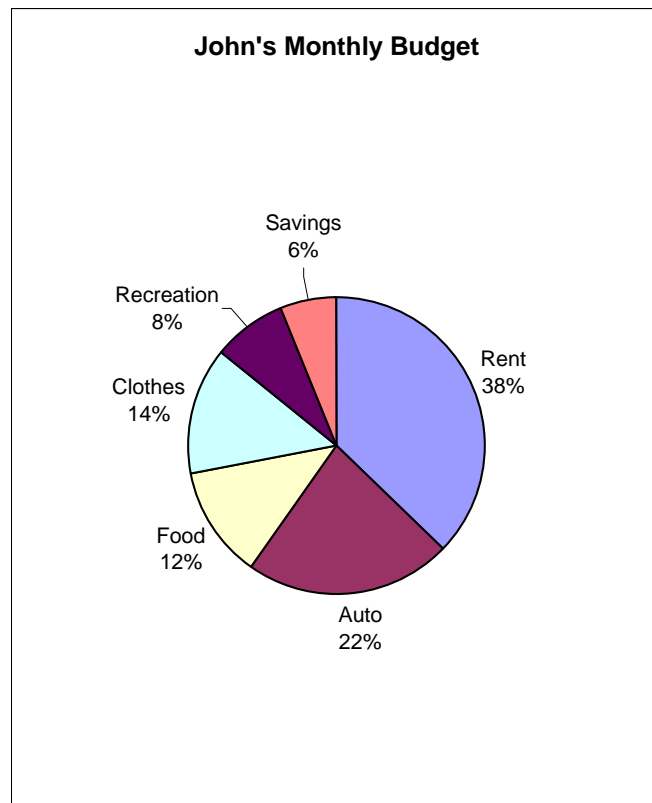
- 1) To the right is a pie chart showing how John plans to spend his money each month. If John's take home salary is \$805.00 each month, how much does he spend on the following:

- a) rent \_\_\_\_\_
- b) clothes \_\_\_\_\_
- c) his automobile \_\_\_\_\_
- d) recreation \_\_\_\_\_
- e) food \_\_\_\_\_
- f) savings \_\_\_\_\_

- 2) Suppose John received a monthly raise of \$50; would that change any of the percentages?

- 3) Suppose he decided to spend the \$50 on recreation only; how would that change the percentages?

Recreation \_\_\_\_\_, rent \_\_\_\_\_, clothes \_\_\_\_\_, automobile \_\_\_\_\_, food \_\_\_\_\_, savings \_\_\_\_\_



**Lesson 3: Constructing Circle Graphs**

**Student Worksheet #2  
Answers**

- 1) (a) \$305.90 (b) \$112.70 (c) \$177.10 (d) \$64.40 (e) \$96.60 (f) \$48.30
- 2) No - This would change the amount of money spent in each category but would not change the percentages.
- 3) Recreation 13%; rent 36%; clothes 13%; auto 21%; food 11%; savings 6%